This listing of claims will replace all prior versions, and listings, of claims in the application:

Listing of Claims:

1. (Original) Apparatus for extending the duration of an optical pulse, comprising:

a delay loop formed by two or more mirrors and a beamsplitter and configured to receive the optical pulse;

said beamsplitter having formed on a surface thereof a plurality of zones each thereof having a reflectivity;

said mirrors and said beamsplitter being configured and aligned such that portions of the optical pulse make a predetermined number of round trips in the delay loop, with different portions of the optical pulse being incident on different ones of said beamsplitter zones; and

wherein the reflectivities of said beamsplitter zones are selected such that the pulse extender delivers, via said beamsplitter zones, a sequence of replicas of the optical pulse each thereof having about the same energy, consecutive ones of said pulse replicas being spatially displaced and temporally spaced.

2. (Original) The apparatus of claim 1, further including a beam homogenizer arranged to combine said pulse replicas into a single extended optical pulse.

3. (Original) The apparatus of claim 2, wherein said extended optical pulse has a duration at least three times greater than the duration of said optical pulse.

4. (Original) The apparatus of claim 1, wherein a said pulse portion has a round-trip time in said delay loop, said round-trip time being about equal to the duration of said optical pulse, whereby said optical pulse replicas are temporally spaced, one with respect to the other, such that they are about temporally contiguous.

5. (Original) The apparatus of claim 1, wherein each of said optical pulse replicas has a beam width, said beam widths are about equal, and consecutive ones said pulse replicas are

spatially displaced one with respect to the other, in the width direction thereof, by about a said beam width.

6. (Original) The apparatus of claim 5, wherein each of said optical pulse replicas has a beam height, and said beam heights are about equal.

7. (Original) The apparatus of claim 1, wherein said predetermined number of round trips is at least three.

8. (Original) The apparatus of claim 7, wherein said predetermined number of round trips is three, wherein said beamsplitter surface has first, second, third, and fourth ones of said reflectivity zones, and wherein a sequence of four pulse replicas is delivered.

9. (Original) The apparatus of claim 8, wherein each of said reflectivity zones has a different transmissivity, and wherein the first pulse replica in said sequence is reflected from said first reflectivity zone, and the second, third, and fourth pulse replicas are transmitted through respectively said second, third, and fourth reflectivity zones.

10. (Original) The apparatus of claim 9, wherein the reflectivity of said fourth reflectivity zone is about zero.

11. (Original) The apparatus of claim 7, wherein said predetermined number of round trips is three, wherein said beamsplitter surface has first, second, and third ones of said reflectivity zones, and wherein a sequence of four pulse replicas is delivered.

12. (Original) The apparatus of claim 11, wherein each of said reflectivity zones has a different transmissivity, and wherein the first pulse replica in said sequence is reflected from said first reflectivity zone, the second and third pulse replicas are transmitted through respectively said second and third reflectivity zones, and the fourth pulse replica exits said delay loop without passing through said beamsplitter.

13. (Original) The apparatus of claim 7, wherein said predetermined number of round trips is five, wherein said beamsplitter surface has first, second, third, and fourth ones of said reflectivity zones, and wherein a sequence of four pulse replicas is delivered.

14. (Original) The apparatus of claim 13, wherein each of said reflectivity zones has a different transmissivity and wherein the first, second, third, and fourth pulse replicas are transmitted through respectively said first, second, third, and fourth reflectivity zones.

15. (Original) The apparatus of claim 1, wherein said delay loop is formed by three concave spherical mirrors and said beamsplitter, and said surface of said beamsplitter on which said reflectivity zones are formed is a plane surface.

16. (Original) The apparatus of claim 1, wherein said delay loop is formed by three concave spherical mirrors and said beamsplitter, and said surface of said beamsplitter on which said reflectivity zones are formed is a concave spherical surface.

17. (Original) The apparatus of claim 16, wherein said beamsplitter is an optical element having a meniscus shape and having zero dioptric power.

18. (Original) The apparatus of claim 1, wherein said delay loop is formed by a plane mirror, a concave spherical mirror and said beamsplitter and said surface of said beamsplitter on which said reflectivity zones are formed is a concave spherical surface.

19. (Original) The apparatus of claim 18, wherein said beamsplitter is an optical element having a meniscus shape and having zero dioptric power.

20. (Original) The apparatus of claim 1, wherein said delay loop is formed by two concave spherical mirrors and said beamsplitter and said surface of said beamsplitter on which said reflectivity zones are formed is a plane surface.

21. (Original) Apparatus for extending the duration of an optical pulse, comprising:

a delay loop formed by two or more mirrors and a beamsplitter and configured to receive the optical pulse, the optical pulse having a beam width;

said beamsplitter having formed on a surface thereof a plurality of zones each thereof having a width about equal to said beam width and each thereof having a reflectivity and each thereof being at least partially transmissive;

said mirrors and the beamsplitter being configured, spaced, and aligned such that the optical pulse propagates around said loop along a path making a predetermined number of round trips in the delay loop, with said beam width at said beamsplitter being the same after each round trip and with the time for a said round trip being about equal to the duration of the optical pulse;

said mirror and beam alignment being such that said path at said beamsplitter is displaced after each of said round trips by said beam width and said pulse is incident in a different one of said zones after each of all but a last of said round trips; and

wherein the reflectivities of said beamsplitter zones are selected such that the pulse extender delivers from said delay loop, via one or more of reflection from a beamsplitter zone, transmission through a said beamsplitter zone, and transmission past said beamsplitter, a sequence replicas of the optical pulse, each thereof having about the same energy, each thereof having about the same beam width, and with consecutive ones of said pulse replicas being spatially displaced, one with respect to the next, by said beam width and temporally spaced, one with respect to the next, by said pulse duration.

22. (Original) The apparatus of claim 21, wherein said predetermined number of round trips is three, wherein said beamsplitter surface has first, second, third, and fourth ones of said reflectivity zones, and wherein a sequence of four pulse replicas is delivered.

23. (Original) The apparatus of claim 22, wherein each of said reflectivity zones has a different transmissivity, and wherein the first pulse replica in said sequence is reflected from said first reflectivity zone, and the second, third, and fourth pulse replicas are transmitted through respectively said second, third, and fourth reflectivity zones.

24. (Original) The apparatus of claim 23, wherein the reflectivity of said fourth reflectivity zone is about zero.

25. (Original) The apparatus of claim 21, wherein said predetermined number of round trips is three, wherein said beamsplitter surface has first, second, and third ones of said reflectivity zones, and wherein a sequence of four pulse replicas is delivered.

26. (Original) The apparatus of claim 25, wherein each of said reflectivity zones has a different transmissivity, and wherein the first pulse replica in said sequence is reflected from said first reflectivity zone, the second and third pulse replicas are transmitted through respectively said second and third reflectivity zones, and the forth pulse replica exits said delay loop without passing through said beamsplitter.

27. (Original) The apparatus of claim 21, wherein said predetermined number of round trips is five, wherein said beamsplitter surface has first, second, third, and fourth ones of said reflectivity zones, and wherein a sequence of four pulse replicas is delivered.

28. (Original) The apparatus of claim 27, wherein each of said reflectivity zones has a different transmissivity and wherein the first, second, third, and fourth pulse replicas are transmitted through respectively said first, second, third, and fourth reflectivity zones.

29. (Original) The apparatus of claim 21, wherein said delay loop is formed by three concave spherical mirrors and said beamsplitter, and said surface of said beamsplitter on which said reflectivity zones are formed is a plane surface.

30. (Original) The apparatus of claim 21, wherein said delay loop is formed by three concave spherical mirrors and said beamsplitter, and said surface of said beamsplitter on which said reflectivity zones are formed is a concave spherical surface.

31. (Original) The apparatus of claim 30, wherein said beamsplitter is an optical element having a meniscus shape and having zero dioptric power.

32. (Original) The apparatus of claim 21, wherein said delay loop is formed by a plane mirror, a concave spherical mirror and said beamsplitter and said surface of said beamsplitter on which said reflectivity zones are formed is a concave spherical surface.

33. (Original) The apparatus of claim 32, wherein said beamsplitter is an optical element having a meniscus shape and having zero dioptric power.

34. (Original) The apparatus of claim 21, wherein said pulse replicas are delivered along parallel optical paths.

35. Apparatus for extending the duration of an optical pulse, comprising:

a delay loop formed by two or more mirrors and a plurality of beamsplitters, each of said beamsplitters having a reflectivity, said delay loop being configured to receive the optical pulse;

said mirrors and said beamsplitters being configured and aligned such that portions of the optical pulse make a predetermined number of round trips in the delay loop, with different portions of the optical pulse being incident on different ones of said beamsplitters; and

wherein the reflectivities of said beamsplitters are selected such that the pulse extender delivers, via said beamsplitters, a sequence of temporally spaced replicas of the optical pulse each thereof having about the same energy.

36. (Original) The apparatus of claim 35, further including a beam homogenizer arranged to combine said pulse replicas into a single extended optical pulse.

37. (Original) The apparatus of claim 35, wherein said beamsplitters are on a common surface of an optical element.

38. (Original) A method of extending the duration of an optical pulse, comprising the steps of:

dividing the optical pulse into a sequence of at least three replica pulses each of said plurality of pulses having about the same energy;

delaying each of said replica pulses such that said replica pulses form a temporal sequence thereof; and

optically summing said sequence of replica pulses to provide an extended optical pulse having a duration longer than the duration of the optical pulse.

39. (Original) The method of claim 38, wherein consecutive ones of said replica pulses in said sequence are delayed by about the duration of said optical pulse.

40. (Original) The method of claim 39, wherein there are four replica pulses and the duration of said extended optical pulse is about four times the duration of the optical pulse.

41. (Original) Apparatus for extending the duration of an optical pulse, comprising:

a delay loop formed by two or more mirrors and a beamsplitter and configured to receive the optical pulse;

said beamsplitter having formed on a surface thereof a plurality of zones each thereof having a reflectivity;

said mirrors and said beamsplitter being configured and aligned such that portions of the optical pulse make a predetermined number of round trips in the delay loop, with different portions of the optical pulse being incident on different ones of said beamsplitter zones; and

wherein the reflectivities of said beamsplitter zones are selected such that the pulse extender delivers, via said beamsplitter zones, a sequence of replicas of the optical pulse that are spatially displaced and temporally spaced.

42. (Original) An apparatus for extending the length of a laser pulse comprising:

at least two mirrors; and

a beam splitter positioned with respect to the mirrors to define a delay loop, said beam splitter having at least three different zones of differing reflectivity, with the orientation of the mirrors and beam splitter being arranged so that successive passes of a

laser pulse through the delay loop will result in the pulse striking different zones on the beam splitter whereby the apparatus can convert a single input laser pulse into a temporal sequence of replica pulses each having a predetermined energy.